

What is claimed is:

1. A composition comprising:

a) at least one type of ordered, crystalline and microporous material with an average pore diameter less than  
5 15 Angstroms;

b) At least one type of non-crystalline inorganic oxide, said inorganic oxide having mesopores or mesopores and micropores and, wherein said inorganic oxide has a peak  
10 in an X-ray diffraction pattern between 0.3 and 3 degrees in 2θ, and wherein said mesopores are interconnected mesopores.

2. The composition of claim 1 wherein the said crystalline microporous materials are selected from a group consisting of zeolite Beta, zeolite Y, USY, mordenite,  
15 Zeolite L, ZSM-5, ZSM-11, ZSM-12, ZSM-20, Theta-1, ZSM-23, ZSM-34, ZSM-35, ZSM-48, SSZ-32, PSH-3, MCM-22, MCM-49, MCM-56, ITQ-1, ITQ-2, ITQ-4, ITQ-21, SAPO-5, SAPO-11, SAPO-37, Breck-6 and  $\text{ALPO}_4$ -5.

3. The composition of claim 1 wherein the at least one inorganic oxide has at least 97 volume percent mesopores based on micropores and mesopores of the inorganic oxide, a surface area of 400 - 1100 m<sup>2</sup>/g, and a total pore volume of about 0.3-2.2 cm<sup>3</sup>/g.

4. The composition of claim 3 wherein the mesopores have a size ranging from about 2 nm to about 25 nm.

5. The composition of claim 3 wherein the porous inorganic oxide is silicon oxide.

6. The composition of claim 1 further comprising at least one type of metal.

7. The composition of claim 6 wherein the metal is incorporated into the zeolite framework as substitutions of lattice atoms and/or located inside the zeolite micropores.

8. The composition of claim 6 wherein the metal is incorporated into the inorganic oxide inside at least one mesopore wall and/or on at least one mesopore surface.

5           9. The composition of claim 6 wherein the metal is at least one metal selected from the group consisting of aluminum, titanium, vanadium, zirconium, gallium, boron, manganese, zinc, copper, gold, lanthanum, chromium, molybdenum, nickel, cobalt, iron, tungsten, palladium and  
10           platinum.

10. The composition of claim 1 wherein the composition percentage by weight of the crystalline microporous material ranges from about 3% to about 90%.

15           11. The composition of claim 1 wherein the composition percentage by weight of the microporous zeolite ranges from about 4% to about 80%.

12. A method for making a catalytic material which comprises the steps of:

a) pretreating a zeolite;

5 b) combining the pretreated zeolite with water, an inorganic oxide or a precursor of an inorganic oxide, and at least one mesopore-forming organic compound to form a mixture;

c) drying the mixture;

10 d) heating the dried mixture to a temperature and for a period of time sufficient to form a mesoporous inorganic oxide structure.

13. The method of claim 12 wherein the zeolite is a lammellar zeolite and the pretreatment includes delamination  
15 or intercalation of the lamellar zeolite.

14. The method of claim 13 wherein said delamination is accomplished by contacting the lamellar zeolite with an

alkali solution of cationic surfactant under conditions allowing the lamellar zeolite to swell and delaminate.

15. The method of claim 13 wherein the delamination of  
5 the zeolite comprises subjecting the zeolite to ultrasonic treatment.

16. The method of claim 12 wherein the pretreatment  
includes ion exchange, impregnation, immobilization of  
10 functional species and/or steaming.

17. The method of claim 12 wherein the mesopore-forming  
organic compound is selected from the group consisting of  
glycerol, diethylene glycol, triethylene glycol,  
15 tetraethylene glycol, propylene glycol, triethanolamine,  
triisopropanolamine, starch, sulfolane, tetraethylene  
pentamine and diethylene glycol dibenzoate.

18. The method of claim 12 wherein said mesopore-forming organic compound has a boiling point of at least 150°C.

5            19. The method of claim 12 wherein the inorganic oxide is formed by reacting an inorganic oxide precursor with water.

10           20. The method of claim 12 wherein the mixture is maintained at a pH above about 7.0.

15           21. The method of claim 14 wherein the mixture is dried by heating in air at a temperature and for a period of time sufficient to drive off at least a major portion of the water and mesopore-forming organic compounds.

            22. The method of claim 12 wherein the heating step (d) comprises heating the dried mixture to a temperature of from about 100°C to about 250°C.

23. The method of claim 12 further comprising the step of calcining the heated dried mixture at a temperature of from about 300°C to about 1000°C for at least a period of time sufficient to effect removal of the mesopore-forming organic compound from the mesoporous, inorganic oxide support.

24. The method of claim 12 further comprising combining metal ions with the mixture, the metal being selected from the group consisting of aluminum, titanium, vanadium, zirconium, gallium, boron, manganese, zinc, copper, gold, lanthanum, chromium, molybdenum, nickel, cobalt, iron, tungsten, palladium and platinum.

25. The method of claim 12 further comprising the steps of admixing a binder with the catalytic material and forming the catalytic material into a predetermined shape.

26. A method for making a catalytic material which comprises the steps of:

a) contacting a lamellar structured zeolite with an alkaline solution of cationic surfactant under conditions allowing the lamellar zeolite to swell;

b) combining the swollen zeolite with water, an inorganic oxide or a precursor of an inorganic oxide, and at least one mesopore-forming organic compound to form a mixture;

c) delaminating the lamellar zeolite;

d) drying the mixture;

e) heating the dried mixture to a temperature and for a period of time sufficient to form a mesoporous oxide structure.

27. The method of claim 26 wherein said mesopore-forming organic compound is selected from the group consisting of glycerol, diethylene glycol, triethylene glycol, tetraethylene glycol, propylene glycol,



triethanolamine, triisopropanolamine, sulfolane,  
tetraethylene pentamine and diethylene glycol dibenzoate.

28. The method of claim 26 wherein said mesopore-  
5 forming organic compound has a boiling point of at least  
150°C.

29. The method of claim 26 wherein the inorganic oxide  
is formed by reacting an inorganic oxide precursor with the  
10 water.

30. The method of claim 29 wherein the inorganic oxide  
precursor is selected from the group consisting of silica  
sources and alumina sources.

31. The method of claim 26 wherein the mixture is  
15 maintained at a pH above about 7.0.

32. The method of claim 26 wherein the mixture is dried by heating in air at a temperature and for a period of time sufficient to drive off water and volatile organic compounds.

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33. The method of claim 26 wherein the heating step (e) comprises heating the dried mixture to a temperature of from about 100°C to about 250°C.

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34. The method of claim 26 wherein the heating step (e) comprises heating the dried material to a temperature of from about 150°C to about 200°C.

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35. The method of claim 26 further comprising the step of calcining the heated dried mixture at a temperature of from about 300°C to about 1000°C.

36. The method of claim 26 further including the step of calcining the heated dried mixture at a temperature of

from about 400°C to about 700°C for about 2 hours to about 40 hours.

37. The method of claim 26 further comprising combining metal ions with the mixture, the metal being selected from the group consisting of aluminum, titanium, vanadium, zirconium, gallium, boron, manganese, zinc, copper, gold, lanthanum, chromium, molybdenum, nickel, cobalt, iron, tungsten, palladium and platinum.

38. The method of claim 26 further comprising the steps of admixing a binder with the catalytic material and forming the catalytic material into a predetermined shape.

39. A process for treating a hydrocarbon feed comprising:

contacting a feed containing at least one hydrocarbon component with a catalytically effective amount of a catalyst which includes at least one zeolite supported on a

porous inorganic oxide under reaction conditions sufficient to effect conversion of said hydrocarbon component, said porous inorganic oxide having at least 97 volume percent mesopores based on micropores and mesopores of the porous inorganic oxide, having surface area of about 400-1100 m<sup>2</sup>/g and having at least one x-ray diffraction peak between 0.3 and 3 degrees in 2θ.

40. The process of claim 39 wherein the conversion of the hydrocarbon component is effected by means of a reaction selected from the group consisting of acylation, alkylation, dimerization, oligomerization, polymerization, dewaxing, hydration, dehydration, disproportionation, hydrogenation, dehydrogenation, aromatization, selective oxidation, isomerization, hydrotreating, catalytic cracking and hydrocracking.

41. The process of claim 39 wherein said feed includes an aromatic compound and acylation agents and the reaction

is an acylation reaction conducted under acylation reaction conditions sufficient to effect acylation of the aromatic compound with the acylation agents.

5           42. The process of claim 41 wherein said acylation agents include carboxylic acid anhydrides, acyl halides.

10           43. The process of claim 41 wherein the acylation reaction conditions include a temperature of from about 20°C to about 350°C, a pressure of from about 1 bar to about 110 bars, and a space velocity of from about 0.1 WHSV to about 20 WHSV.

15           44. The process of claim 39 wherein said feed includes a fraction of petroleum and the reaction conditions are sufficient to effect catalytic cracking of the fraction.

          45. The process of claim 44 wherein said a fraction of petroleum includes at least one component having an initial

boiling point of from about 200°C to about 260°C and an end  
boiling point of from about 400°C to about 455°C.

46. The process of claim 45 wherein said fraction of  
petroleum further comprises at least one component having a  
boiling point above about 540°C.

47. The process of claim 46 wherein the component  
having a boiling point above 540°C is an undeasphalted  
petroleum residue, deasphalted petroleum residue, tar sand  
bitumen, shale oil, or coal liquid.

48. The process of claim 44 wherein the reaction  
conditions include a temperature of from about 400°C to  
about 650°C, a catalyst to feed weight ratio from about 3.1  
to 10:1.

49. The process of claim 39 wherein said feed includes  
a fraction of petroleum and the reaction conditions are

sufficient to effect hydrocracking of the fraction to produce a relatively lighter hydrocarbon product.

5 50. The process of claim 49 wherein said fraction of petroleum contains at least one component having a boiling point above about 260°C.

10 51. The process of claim 49 wherein said fraction of petroleum contains at least one component having a boiling point above about 290°C.

15 52. The process of claim 49 wherein said fraction of petroleum contains at least one component having a boiling point above about 340°C.

53. The process of claim 50 wherein said fraction of petroleum further comprises at least one component selected from the group consisting of undecasphalted petroleum

residue, deasphalted petroleum residua, tar sand bitumen, shale oil and coal oil liquid.

54. The process of claim 49 wherein said relatively  
5 lighter hydrocarbon product includes a component selected from the group consisting of middle distillate component having a boiling point ranging from 150°C to 400°C, diesel fuel and lube base oil.

10 55. The process of claim 39 wherein the conversion of the hydrocarbon component is effected by means of hydroisomerization and the reaction conditions include a temperature of from about 150°C to about 500°C, a pressure from about 1 bar to about 240 bars, and a WHSV from about  
15 0.1 to about 20.